Space Weather Technical Forecast

Issued on Monday, 10 April 2023 at 12:29 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of M-class flares (R1-R2 Minor-Moderate radio blackouts) throughout. Chance of G1/Minor Storm intervals late day 2 (11th) into day 3 (12th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been moderate with occasional C-class flares and an isolated M2.8 flare at 10/0520 UTC. This occurred from the southeast limb, where a large plage region is just starting to appear. Otherwise, there are currently 5 sunspot regions on the visible disc. AR3272 remains the largest and most complex regions on the disc. It has continued to mature and is classified Fai/Beta-Gamma. AR3273, in the northeast has continue to develop, and is now classified Dai/Beta. AR3275 near the northeast limb has moved further in to view and looks just to be a single Hsx/Alpha spot. There are two other regions on the disc near the meridian but both are small and simple.
No Earth directed CMEs were observed in the period, although a filament in the northwest, to the north of AR3273, looks to have partially lifted. We are awaiting further imagery to determine if this produced a CME.

Solar Wind / Geomagnetic Activity: The Solar wind as measured by ACE and DSCOVR at L1 appear to show a small enhancement from a transient feature followed by a more significant enhancement due to the arrival of a positive coronal hole CIR and high speed stream. Solar wind speeds were slow through much of the period, but increased from around 10/0730 UTC to around 500 km/s. Density was initially below average but steadily increased to peak at 36 ppcc at 10/0549 UTC. It then continued at average or slightly above average levels. Total magnetic field strength was weak and steady, but increased to moderate from 09/2200 UTC, ranging between 8 and 13 nT. The north-south component of the magnetic field was weakly negative 09/2300 UTC to 10/0730 UTC, but has been more variable thereafter between -2 and +10 nT. Phi angle was generally negative (towards the Sun), until 10/0615 UTC, when it switched to a positive (away from the Sun) orientation. Geomagnetic activity was Quiet (Kp 0-2), but became Unsettled (Kp 3) from midnight, with a period of Active observed 10/0600-0900 UTC.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as measured at GOES16, was at background. The high energy electron flux (greater than 2MeV), as measured at GOES16 started at High levels, with a peak of 1850pfu at 09/1600UTC, but subsequently declined to background levels. The associated 24 hour fluence was below the Active threshold with a declining trend. The 10/0000 UTC observed fluence was 6.56e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate, with a chance of further isolated M-flares. AR3272 and AR3273 are the most likely sources of activity, but a new region appearing round the southeast limb over the next 24 hours also has potential.

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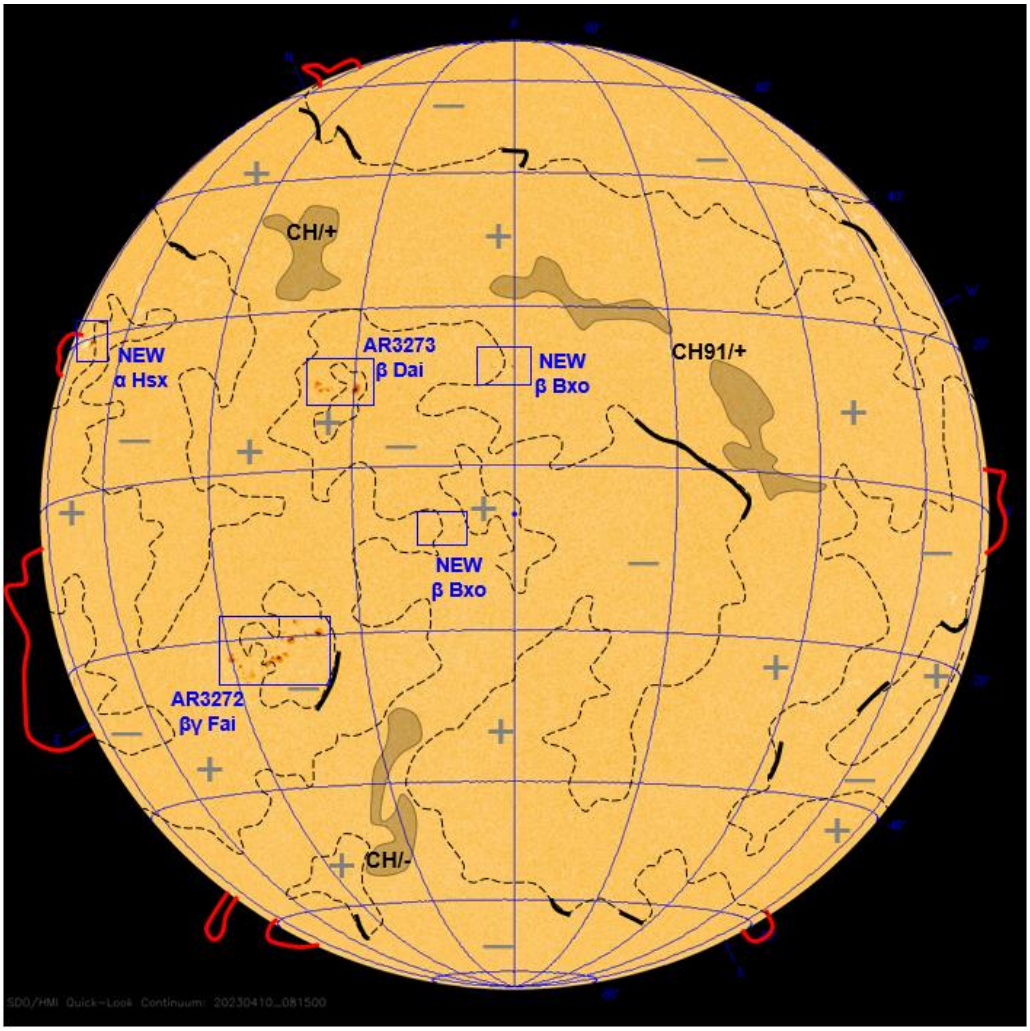
Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, with a low possibility of a glancing blow either late on 11 or early on 12 Apr. Slightly elevated to elevated solar winds due to a positive coronal hole high speed stream, may become further enhanced later on day 2 (11th) into day 3 (12th) if the CME mentioned above arrives, before winds decline towards ambient levels later on day 3 (12th) into day 4 (13th).
Geomagnetic activity is expected to be mainly Quiet to Unsettled, with occasional Active spells and a chance of G1/Minor Storm intervals, most likely if the potential CME arrives on day 2/3 (11th/12th). On day 4 (13th), activity is likely to become predominantly Quiet.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at background levels, but with a slightly increasing risk of >S1 event. High energy (greater than 2 MeV) electron flux is likely to initially be suppressed. A recovery in values is then likely on days 3 and 4 (12th and 13th). Electron fluence is forecast to follow a downward trend through much of the period, however an increase is likely towards the end period, but below the Active threshold.

Figure 1. Solar Analysis Valid 10/0800 utc.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are expected, but a slight glancing blow is possible either late on 11 Apr or during 12 Apr due to a CME from 07 Apr, although this is considered to be a low possibility. A stealth CME appears to have arrived at Earth late on 09 into 10 Apr and any effects will be monitored.
Solar winds are currently slightly elevated to elevated due to a positive coronal hole high speed stream, most likely CH91. They may become further enhanced later on day 2 (11th) into day 3 (12th) if the CME mentioned above arrives, before declining towards ambient levels later on day 3 (12th) into day 4 (13th).
Geomagnetic activity is expected to be mainly Quiet to Unsettled, with occasional Active spells and a chance of G1/Minor Storm intervals, most likely if the potential CME arrives on day 2/3 (11th/12th). On day 4 (13th), activity is likely to become predominantly Quiet.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	30	30	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
08/0107	Partial	Filament	SW	388 km/s	12/0000	Low risk of glancing blow

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Radio Blackouts - X-Ray Flares:

Solar activity has been moderate over the past 24 hours, with one M-flare observed. Further isolated M-flares are possible through the period. Most likely from AR3272 (Fai/Beta-Gamma) in the southeast, which is a large and relatively complex region. Significant activity is also possible from AR3273 in the northeast, which has grown rapidly over the past 24 hours and is now classified Dai/Beta. Another source of potential activity is from a large area of flux, just beyond the southeast limb, that is likely to rotate on to the disc over the next 24 hours, and may be linked to a complex sunspot region. It was this region that was responsible for the M2.8 flare at 10/0520 UTC. There are 3 other sunspot regions presently on the disc but these currently remain small and simple and harbour little flare risk.

X Ray Flares / Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**R1-R2 M Class**	No	40	40	40	40
Very Active	**R3 to R5 X Class**	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

High energy proton flux (greater than 10MeV), as observed by GOES-16, is likely to remain at background levels through the period, although the risk of >S1 event increases slightly through the period as the two larger and more complex sunspot regions (AR3272 and AR3273) transition to the western hemisphere.

Radiation Storms / Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) observed at GOES-16 is currently at background levels due to enhanced geomagnetic activity. Flux levels are expected to increase later in the period due to the reduction in geomagnetic activity high speed stream and possible CME effects wane.
24-hour fluence values are also expected to increase towards the end of the period, but are unlikely to exceed the Active (>1e8 integrated pfu) threshold.

GEO Electron Environment	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	10	20	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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